

ISTITUTO NAZIONALE DI OTTICA
ARCETRI - FIRENZE

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Florence Meeting
on
Problems in Contemporary Optics

Abstracts of the Papers

10-16 September, 1954

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10 - 16 September, 1954

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Friday, September 10, 1954

Session A 1:

"Optics and Information
Theory"

A. BLANC-LAPIERRE - "Utilisation des méthodes de l'analyse harmonique et de la théorie de l'information pour l'étude de la correspondance objet-image en optique".

L'auteur compare les propriétés des transformations qui traduisent le comportement des diverses parties d'un dispositif optique avec celles de dispositifs radioélectriques courants. Il est conduit, à propos de cette étude, à rassembler un certain nombre de résultats relatifs à la notion de cohérence en optique. Ceux-ci sont transposés dans le domaine radioélectrique.

La notion de bande passante appliquée à l'optique est discutée en liason avec celle de pouvoir séparateur ou de limite de résolution. On étudie la possibilité de corriger certains défauts dus à la diffraction. On est conduit à envisager des possibilités d'amélioration du pouvoir séparateur suggérées par la transposition à l'optique d'idées d'origine radioélectrique (voir le rapport "Deux expériences de principe suggérant certaines méthodes pour l'amélioration de la limite de résolution d'un instrument d'optique" par A. Blanc-Lapierre et M. Perrot).

Enfin on discute l'introduction d'un élément d'imprécision jouant en optique le rôle du bruit de fond. On est alors conduit à la transposition à l'optique des principaux résultats de la théorie de l'information.

Friday, September 10, 1954.

Session A 1 :
 "Optics and Information
 Theory"

A. BLANC-LAPIERRE = M. PERROT - "Deux expériences de principe suggérant certaines méthodes pour l'amélioration de la limite de résolution d'un instrument d'optique".

L'un des résultats de l'étude de la correspondance entre un objet bidimensionnel $X[\alpha, \beta]$ (X représente par exemple l'éclairement de l'objet au point α, β) et son image (en lumière monochromatique) est le suivant: si, faisant l'analyse harmonique de l'objet, on le décompose en composantes

$$e^{2\pi i [\xi \alpha + \eta \beta]}$$

de fréquences spatiales respectives $[\xi, \eta]$, il résulte des propriétés de la diffraction que les seules composantes transmises sont celles dont la fréquence spatiale $[\xi, \eta]$ est intérieure à un certain domaine borné \mathcal{D} du plan des fréquences spatiales (composantes Θ_1); toute composante Θ_2 pour laquelle le point $[\xi, \eta]$ est extérieur à \mathcal{D} est éliminée de la transmission et c'est cela qui limite le pouvoir de résolution.

Si un objet $X_1[\alpha, \beta]$ ne possède que des composantes Θ_2 , il est invisible du côté image. L'existence d'un tel objet ne pourra être décelée que si on fait apparaître par un procédé quelconque un système d'ondes Θ_1 lié à $X_1[\alpha, \beta]$. Se référant à des méthodes courantes de radioélectricité on peut penser faire naître un tel système en remplaçant $X_1[\alpha, \beta]$ par $e^{2\pi i [\xi_0 \alpha + \eta_0 \beta]} X_1[\alpha, \beta]$ (changement de fréquence) ou par $X_1^*[\alpha, \beta]$ (détection).

On décrit des expériences de principe à grande échelle illustrant ces possibilités.

Friday, September 10, 1954

Session A 1 :
"Optics and Information
Theory"

Jeanne GAULTIER du MARACHE - "La photographie, filtre de fréquences".

En général, la photographie est un filtre passe-bas. Cependant, si l'objet ne contient que de basses fréquences, la photographie peut créer des fréquences d'ordre plus élevé. Pour un objet quelconque, des techniques spéciales permettent d'étendre considérablement le domaine des fréquences transmises, et même de le prolonger au-delà du domaine des fréquences de l'objet.

Le rapport entre l'amplitude d'une même fréquence dans l'image et dans l'objet est en général représenté par une courbe en cloche, dont la forme est variable. L'allure de cette courbe peut être totalement bouleversée; quand la photographie crée de nouvelles fréquences, le rapport envisagé devient infini; pour un objet périodique, il présente périodiquement des valeurs infinies et nulles.

La transmission des fréquences par la photographie dépend de l'objet, de la nature de l'émulsion et de la technique employée. La seule qualité de l'objet qui est conservée avec exactitude est la position relative de ses éléments; c'est à cette exactitude de position que la photographie doit principalement sa valeur comme procédé d'information.

Friday, September 10, 1954

Session A 2 :
"Optics and Information
Theory"

E.H. LINFOOT - "Informational criteria of image quality and optical design".

The work here described forms part of a joint paper, written in collaboration with Dr. P.B. Fellgett, on the Assessment of Optical Images.

The aberration function of an optical system of the usual kind varies only slowly over its working field; that is to say the field can be divided into areas, large compared with its resolution limit, in each of which its aberration function is substantially invariant. Such an area will be called an isoplanatism patch.

The imaging of a rectangular isoplanatism patch of a self-luminous object can be described by saying that each Fourier element of the intensity distribution $\mathcal{I}(x,y)$ in the isoplanatism patch reappears in the image multiplied by a transmission factor $\tau(u,v)$ which characterises the optical system and which vanishes everywhere outside a certain finite region \mathcal{F} in the (u,v) -plane (frequency plane). \mathcal{F} is determined solely by the aperture of the system; the transmission factor $\tau(u,v)$ is connected in a fairly simple way with its ikonal function. In the coherent case the results are essentially similar; the intensity $\mathcal{I}(x,y)$ is replaced by the complex displacement function $\hat{E}(x,y)$ on the object surface and $\tau(u,v)$ by a new transmission factor $\hat{\tau}(u,v)$ which vanishes everywhere outside a finite region \mathcal{A} in the (u,v) -plane. For the sake of shortness, only the incoherent case is considered in the present account.

To assess the quality of an image on the basis of the information which it contains:, we need to consider:

- (1) the aperture and the ikonal function (or the aberration function) of the optical system,
- (2) the statistics of the "object noise" n_0 and of the "noise" n_2 originating in the receiving surface,
- (3) the "spread function" of the receiving surface,
- (4) the statistics of the presumed object-set.

It is then possible to formulate the analytical conditions which the ikonal function of a camera lens must satisfy in order to maximise the mean information content of image of low-contrast objects.

E.H. Linfoot - "Informational criteria of image quality and optical design". (follows)

Aberration balancing carried out on this basis may be expected to yield optical designs whose information-passing capacity on low-contrast objects is near to a maximum for prescribed aperture and field.

Friday, September 10, 1954

Session A 2 :
"Optics and Information
Theory"

G. TORALDO = M.T. ZOLI - "Optical images considered as stochastic sources".

An optical image can be considered as a source of information. One may ask how much information is contained by an image of a given area, formed by an instrument of a given resolving power. It would be easy to answer this question if the visual world had a completely random constitution. However, due to the statistical relations existing between the illuminations at different points, the real amount of information is much smaller. An experimental investigation has been carried out with a view to discover these statistical laws. A set of real pictures have been analysed photometrically point by point and the probabilities of different successions of illuminations have been worked out. It is hoped that by this procedure it will soon be possible to evaluate the actual amount of information of an image and consequently the redundancy of an optical instrument.

Friday, September 10, 1954

Session A 2 :
"Optics and Information
Theory"

G. TORALDO - "Capacity of the optical channel in the presence of noise".

This research has been based on the two following points:

- 1) Most of the applications of information theory to optics which have been made so far deal with coherent illumination. In this case the utilisation of a number of results obtained in the field of radio communication is almost straightforward. It seems however more important to set up an informational theory of incoherent images, i.e. of what normally represents our visual world.

- 2) The usual definition

$$(1) \quad H = - \int p(x) \log p(x) dx$$

for the entropy of a continuous set of messages has led to some rather common misunderstandings. Such definition is highly conventional, in that an infinite constant is neglected. An amount of information evaluated by means of (1) is meaningless in itself. Only a difference of two expressions like (1) can have a meaning. In other words the amount of information for a continuous set of messages cannot be computed unless noise is taken into account.

Starting from these two remarks a theory has been developed which considers an optical instrument of a given aperture as a communication channel. Noise is represented by the receptor having a finite differential threshold.

In the most common conditions the capacity of the channel turns out to be a universal function of the stray light percentage.

Saturday, September 11, 1954

Session A 3 :
"Optics and Information
Theory"

A. MARECHAL = P. CROCE - "Amélioration de la perception des
détails des images par filtrage des
fréquences spatiales".

On sait que la formation d'une image optique est un filtrage des fréquences spatiales (la nature du filtrage dépend des aberrations, éventuellement de la diffusion dans l'émulsion photographique etc.)

Il est possible d'observer l'image primaire enregistrée sur photographie à l'aide d'un appareil fonctionnant en éclairage cohérent et possédant une courbe de transmission des fréquences spatiales qui compense les variations de transmission dans l'instrument initial. On obtient ainsi une amélioration des contrastes (différente de celle obtenue par renforcement photographique) qui favorise la perception des détails de l'image. On présentera quelques exemples de résultats obtenus sur des objets variés. Il est possible par ce procédé d'atténuer l'effet d'un défaut de mise au point, d'aberrations etc.

Saturday, September 11, 1954

Session A 3 :
"Optics and Information
Theory"

P.M. DUFFIEUX - "La limite du domaine optique d'extension"

Le domaine passe-bas des fréquences linéaires transmises à l'image peut être limité:

- par la structure grenue de la lumière et des surfaces sensibles;
- par leur structure cellulaire;
- par les aberrations et la disparition de la phase dans l'image d'énergie;
- par l'ouverture des faisceaux.

Cette dernière limite est une coupure sans fluctuations; tout le problème du grandissement des images est de l'atteindre.

L'objet tridimensionnel est l'invariant de ses images bidimensionnelles. Dans l'espace tridimensionnel de Fourier les domaines plans d'extension remplissent au plus la sphère de résolution de rayon $2/\lambda$. La fonction de transmission qui remplit cette sphère varie avec le degré de cohérence depuis une constante unitaire pour la cohérence parfaite jusqu'à la décroissance régulière de l'unité à zéro vers les hautes fréquences pour l'incohérence. L'incohérence est une perte d'information sur l'objet.

L'objet de l'imagerie cohérente est un champ d'interactions avec la lumière. Il existe pour chaque objet une sphère maximale de résolution, fixée par le quanta susceptible de le détruire. Il subsiste donc toujours, dans la définition optique d'un objet, au delà de sa barrière mécanique de potentiel, une auréole de diffraction qui peut être interprétée comme le produit d'un facteur de structure qui dépend du rayonnement utilisé et d'un facteur de convergence qui représente, à distance suffisante, les champs newtoniens incohérents. Il est probable qu'au voisinage de la barrière de potentiel ce champ doit évoluer vers des champs cohérents superficiels qui représentent l'aspect optique des phénomènes superficiels connus de la chimie-physique.-

Saturday, September 11, 1954

Session A 3 :

"Optics and Information
Theory"

P.M. DUFFIEUX - "Questions posées à la théorie de l'information".

Le signal, comme, en Optique, l'Objet, est attendu. Sa définition est la conclusion d'un choix. D'un autre côté la vue n'est pas seulement un sens d'analyse et de compréhension mais aussi de contrôle et de suggestion. La distinction des objets, la troisième dimension de l'espace lui viennent du toucher et du mouvement dont elle est généralement d'auxiliaire. L'Optique a toujours été plus ou moins asservie à la Mécanique. Ce sont ces subjectivités et soumissions qui autorisent à parler de qualité.

Telle qu'elle est donnée par D. Gabor ou Blanc-Lapierre, la Quantité d'Information exige quelques compléments. - Quel est le rôle de la mise au point dont les solutions proposées sont indépendantes? - Celui de la cohérence ou de l'incohérence qui correspondent à deux types de transmission? - Comment peut-elle évoluer de l'appareil parfait à l'appareil réel? - L'objet sur lequel informe l'image n'est il pas une projection, en retour, de l'image? - Comment les images bidimensionnelles s'intègrent-elles en objet tridimensionnel? - Comment évaluer la quantité d'information lorsque le renseignement est un "signal" demandé à l'objet, par exemple une dimension, et non "tout" l'objet? - Quelle est la définition objective de l'objet?

Saturday, September 11, 1954

Session A 3 :
"Optics and Information
Theory".

P. FELLGETT - "An informationally-efficient method for the measurement of radial velocities".

The raw data yielded by a well-designed physical experiment contain implicitly a contribution to the answers of the questions which the experiment was intended to elucidate. The process of "interpretation" or "reduction" of the data consists in making these answers explicit. Evidently no new true information can be added during this process, unless new data are introduced, and it is undesirable that information should be lost. An "ideal" interpretative process is therefore one which conserves the information relevant to the questions with which the experiment is concerned. The efficiency of an interpretative process can be assessed by comparing the appropriate information content of the raw data with that of the explicit answers obtained from them. Woodward and Davis have shown, with particular reference to radar, that the logarithm of the probability, that a pulse of known shape is present at a given position in a measured noisy waveform, is the cross-correlation function between the observed waveform and the known pulse shape. They also show that this interpretative process conserves information relating to the existence and position of the pulse.

Since the information-passing capacity of a physical apparatus is limited, it is desirable that this channel capacity should not be wasted on information which is irrelevant to the final answer sought. This applies with particular force when the effects investigated are close to the fluctuation limit of measurement, as occurs in optics when apparently faint sources, such as stars, are measured. It is very inefficient, in this respect, to use a spectrograph to measure detailed multi-dimensional information about the spectrum of a star in order to obtain finally only a one-dimensional datum such as the radial-velocity. This information inefficiency is an important reason why radial velocity measurement in this way requires long exposures and has an unfavourable faint limit. The following method of overcoming this inefficiency appears to be practicable.

The whole of the spectrum of a star may be regarded as the "pulse" of the Woodward and Davis theory, and the required cross-correlation function can be obtained by an optical-analogue method. The spectrum of the star to be measured is focus-

P. Fellgett - "An informationally efficient method for the measurement of radial velocities". (follows)

sed into a previously prepared developed plate of the spectrum of a star of the same type and known radial velocity (the spectral type can be determined photometrically), and the total transmission through the plate is measured photo-electrically as a function of a simulated Doppler shift of the plate relative to the star spectrum. In this way the radial velocity is measured directly at the telescope. The method gives greater weight to lines that are sharper or stronger, and this weighting is ideal in so far as the assumption of the Woodward and Davis theory are fulfilled. A substantial part of the light collected by the telescope reaches the photocell, and this proportion depends very little on the dispersion. Accordingly, it is possible to measure the total effect of a large number of lines which are individually beyond the limit of detection in faint stars or galaxies. The time required to make a measurement of given accuracy depends on the previous uncertainty in the radial velocity, as it must do in an informationally efficient method because the information gain which the measurement represents is itself a function of the a priori uncertainty.

Saturday, September 11, 1954

Session B 1 :
"Non-Classical Image-
Forming Device"

A.C.S. VAN HEEL - "Transfer of optical images by means of a
bundle of thin transparent wires".

The light entering the end of one of the wires leaves the wire at the other end with little loss, provided it is optically isolated from the other wires. Total reflection at the walls of each wire takes care of the transfer of the light.

Isolation can be attained by means of a coating with a substance of lower refractive index. With a proportion of 0,96 for the indices of coating and core, apertures up to 1 : 1.8 can be handled.

Applications lie there where the flexibility of the transporting bundles is of advantage. With suitable irregular formation two dimensional codation and decodation can be achieved.

Saturday, September 11, 1954

Session B 1 :
"Non-Classical Image-
Forming Devices"

H.H. HOPKINS = N.S. KAPANY - "Transparent fibres for the transmission of optical images".

An account is given of earlier experiments (Nature 173, p.39 Jan. 2 1954) in which a flexible bundle of fine glass fibres was successfully used for the transmission of optical images.

Some more recent photometric and other studies of the optical properties of fibre bundles will be described, together with some further applications.

It is hoped that a demonstration will be given.

Saturday, September 11, 1954

Session B 1 :
"Non-Classical Image-
Forming Devices"

M. FRANCON - "Application des tubes conducteurs de lumière en photométrie microscopique".

Afin d'éviter des difficultés au point de vue stabilisation des sources il est avantageux d'utiliser, pour la photométrie au microscope, la même source pour éclairer la préparation et la plage de la source de comparaison.

Un dispositif très simple peut être réalisé en empruntant une partie de la lumière de la lampe et en la "conduisant" au moyen d'un tube de matière plastique jusqu'au cube de Lummer situé dans l'oculaire du microscope.

Saturday, September 11, 1954

Session B 2 :
"Optics and Information
Theory"

LAURA RONCHI - "Fresnel mirrors satisfying the sine condition".

A spherical mirror based on the principle of Fresnel lenses. is corrected for spherical aberration and sagittal-cona for any aperture.

The 3rd order aberrations are equal or less than those of the usual spherical mirrors.

LAURA RONCHI - "Aberrations introduced by a toric section in a configuration lens".

The geometrical aberrations introduced by a toric connection in a configuration lens with symmetry of revolution are computed.

Some tables and diagrams give the variations of the focal length of the principal points and of the spherical aberration as functions of the parameters of the system. From these data it is possible to select for each particular system, the torus which is the most convenient and which are the variations to be applied to the configuration of the system, in order to render so small as to be negligible the total aberrations.

Saturday, September 11, 1954

Session B 2:
"Non-classical Image-
Forming Devices".

G. TORALDO - "Third order correction of a configuration system".

A number of configuration lenses for high-speed scanning have been developed in the last years. Many workers have looked for lenses effecting a perfect collimation in a mathematical sense. This is much more than is actually required, as is well known in applied optics, where perfect instruments are practically never met. A good optical instrument is only an instrument where the aberrations are smaller than the tolerance. A perfect optical instrument, even if it were realizable, would work no better than a good optical instrument. The same philosophy can be applied to the design of microwave lenses, where tolerances are much larger than in optics. To this end the author has worked out the formulae for the third order aberration of a configuration lens consisting of two or more developable surfaces of revolution. It turns out that the third order aberration can vanish in a number of cases of practical interest. Some of these lenses have been constructed and tested with excellent results.

G. TORALDO - "Perfect configuration lenses of revolution".

A family of configuration lenses of revolution is described which collimate the rays from a point feed each on a cone of a given aperture. Collimation is mathematically perfect. The R.C.A. "Lamp-shade", the Renihart-Luneberg lens and the sphere are found to be particular members of this family. A fourth member is described, which presents excellent scanning properties. The corresponding lens has been constructed and tested. The results are in perfect agreement with the theory.

Monday, September 13, 1954

Session C 1 :
"3D and Anamorphic Systems"

W.D. WRIGHT - The perception of depth: the relative influence of the monocular and binocular factors in three-dimensional pictures".

Retinal disparity, convergence, motion parallax, angular size, perspective, overlay, sharpness of outline, etc., all contribute to the perception of distance, and their influence in normal viewing situations is briefly discussed.

The contribution of these factors in three-dimensional reproductions and the extent to which they may give conflicting information about the size and distance of objects in the scene, are then considered. The need is stressed for maximum possible harmony of the different clues, if a compelling, undistorted and unambiguous sense of depth is to be evoked and if successful 3D pictures are to be produced.

Monday, September 13, 1954

Session C 1 :

"3D and Anamorphic systems"

A. ARNULF = "Problèmes posés par la projection des images en relief".

Une solution possible de la photographie en relief utilise le principe de la photographie intégrale de Lippman, sous la forme que lui ont données Ives (parallax panoramagrams), puis plus tard en France, Bonnet (reliephographie). On examinera, dans cette communication:

- (1) - Comment doit être modifié le dispositif d'Ives pour être adapté à l'emploi de films, c'est à dire éviter l'effet des déformations de la pellicule et des légers déplacements latéraux qui se produisent inévitablement dans les couloirs des appareils de prise de vue et de projection (emploi de film gaufré, écrans de prise de vue à panneaux cannelés multiples, etc..)
- (2) - Quelles sont les limitations imposées à ce procédé par la diffraction, les propriétés des émulsion et les instruments. D'un point de vue général, on constate que:
 - (a) La prise de vue nécessite une longueur de film beaucoup plus grande que la cinématographie ordinaire.
 - (b) Le film de 35 mm. est trop étroit.
 - (c) La disposition des spectateurs dans une salle de projection est strictement imposée, d'où résulte que le nombre des spectateurs sera beaucoup plus limité que dans une salle normale.

Monday, September 13, 1954

Session C 1 :
"3D and Anamorphic Systems"

G. FRANKE - "Anwendung und Korrektion Brewsterscher Systeme".

Das Brewsterschen Prismensystem zur Erzeugung einer verzerrten (anamorphotischen) Abbildung eignet sich in der einfachen Form nur für subjektiven Gebrauch. Für eine reelle Abbildung sind die Bildfehler zu gross. Es gelingt indessen, in einem zweistufigen System und bei geeigneter Glaswahl alle Bildfehler soweit zu beseitigen, dass eine einwandfreie Abbildung zustande kommt. Das zweistufige Brewstersche System eignet sich auch gut zu einer pankratischen Anordnung, wie sie in manchen Fällen erwünscht ist.

Monday, September 13, 1954

Session C 1 :
"3D and Anamorphic Systems"

A. BOUWERS = B.S. BLAISSE - "New Anamorphic Mirror System".

The application of mirrors as anamorphic systems has the advantages that chromatic aberrations are excluded and that excellent image quality is achieved with only a few optical components.

The fundamental form of the systems to be described consists of two parallel cylindrical mirrors, one concave and one convex, set up under an angle with the optical axis of the projection lens.

The mirrors may be incorporated in a glass rhombohedron with the maintenance of the apochromatic correction. The dimensions of the system can thus be reduced.

This simple system has the favourable effect of correcting the upward curvature of projected horizontal lines in cinema theatres where the projector is directed downward towards the curved screen.

In the case of straight horizontal projection and in that of the taking of squeezed films in combination with a cine-camera this "horizon curvature" is optically corrected and abolished by two methods.

With the first method a second mirror system with opposite distortion is added to the existing set of cylindrical mirrors. With the second method the mirrors are arranged nearly perpendicularly to the optical axis. This is possible by incorporating the cylindrical mirrors in two prisms separated by a thin layer of air at which the light is twice totally reflected and once transmitted.

Monday, September 13, 1954

Session D 1 :
"Miscellaneous Subjects"

J.W. PERRY - "Energy relations in monochromator performance".

The formation of a finite image in a spectroscope is considered as a diffraction phenomenon and relations in terms of absolute energy distribution are derived for strictly monochromatic, broad (resonance) line and continuous sources. The selective effect of an exit slit with variable position is formulated and the total output of a monochromator determined in relation to its controlling factors for such sources.

Application of the relations deduced are made to investigate the apparent form of a spectrum line when scanned by a finite exit slit and photoelectric receiver, and the conditions for a level, constant-energy peak, free from ripple, to a given accuracy are examined. A relation for monochromator output with spectrally continuous sources, deduced by the writer (1938) on a geometrico-optical basis, is confirmed subject to a correction for diffraction effects here deduced, affecting output and purity.

Monday, September 13, 1954

Session D 1 :
"Miscellaneous Subjects"

D. RICHARDSON -"Modern diffraction gratings and spectrographs".

A brief discussion of the methods that have been successful in producing substantial quantities of top quality gratings will be followed by a review of recent advances in the design of grating spectrographs.

Monday, September 13, 1954

Session D 1 :
"Miscellaneous Subjects"

A.C.S. VAN HEEL - "Observations on the solar eclipse of June 3,
1954, made by the Delft expedition".

ABSTRACT NOT RECEIVED.

Monday, September 13, 1954

Session D 1 :

"Miscellaneous Subjects"

F. GABLER - "Eine neue Phasenkontrasteinrichtung für das Mikroskop".

Vor kurzem hat A. Wilska über eine neue Methode in der Lichtmikroskopie berichtet, die darin besteht, an Stelle des orthodoxen Phasenringes einen hochaperturigen Ring aus Kerzenruss auf eine Objektivlinse aufzubringen und im übrigen das so modifizierte Objektiv so zu verwenden, als wäre es eines der bekannten Phasenkontrastobjektive, also mit Phasenkontrastkondensor mit korrespondierender Ringblende usw.

Der Erfolg dieser Methode - hohes Auflösungsvermögen und ganz hervorragender Bildkontrast - ist unbestritten.

Inzwischen wurde durch interferometrische Messung festgestellt, dass diese Russchichten Phasenverschiebungen in der Größenordnung von 90° hervorrufen. Damit ist der Beweis erbracht, dass die Wilska-Methode mit negativem Phasenkontrast und sehr starker Absorption des Phasenringes arbeitet.

Bei den üblichen Phasenringen hoher Absorption ergeben sich bekanntlich Schwierigkeiten durch das parasitäre Licht. Die Russchichten sind natürlich von diesem Fehler frei und es gelang auch an Stelle des Russringes einen anderen, viel widerstandsfähigeren Kontrastbelag mit den üblichen Hochvakuumbedampfungsmethoden herzustellen. Wir haben diesen "Anoptal"-Belag genannt.

Mit diesem Belag wurde tatsächlich ein wesentlicher Fortschritt in der Phasenkontrastmikroskopie erzielt. Dies wird an Hand von Bildern demonstriert.

Es ist aber auch bekannt, dass bei starker Absorption des Phasenringes die sog. "Inversion" auftritt, so dass aus den im Bild gesehenen Helligkeitsverhältnissen nicht mehr mit Sicherheit auf die vom Präparat erzeugten Gangunterschiede geschlossen werden kann. An ausgewählten Präparaten wird der Einfluss der Inversion diskutiert und auch nachgewiesen, dass es bei biologischen Objekten trotzdem und zwar nur mit negativem Phasenkontrast, möglich ist, eindeutige Resultate zu gewinnen.

Monday, September 13, 1954

Sessi on D 2 :
"Miscellaneous Subjects"

J. PIGT - "Neue Untersuchungen zur Totalreflexion".

Kurze Inhaltsangabe:

Unter Benutzung der vom Vortragenden 1925 angegebenen allgemeinen Formel zur wellen-und beugungstheoretischen Behandlung optischer Strahlenbündel beliebiger Aberration, d.h. beliebig deformierter Wellenflächen, wird die Behandlung der Totalreflexion, u. zw. der totalreflektierten Welle durchgeführt und es werden aus den Ergebnissen dieser Untersuchung geometrisch-optische Folgerungen über den Strahlverlauf gezogen. Dabei zeigt sich, dass für einen zur Trennungsebene parallel schwingenden Dipol die totalreflektierte Welle nicht nur sphärische Aberration, sondern darüber hinaus eine Art Astigmatismus besitzt, während sie für die Strahlung eines zur Trennungsebene beider Medien senkrechten Dipols nur sphärische Aberration besitzt. Es werden weitere Folgerungen mitgeteilt.

Monday, September 13, 1954

Session D 2 :
"Miscellaneous Subjects"

W. FRANZ - "On the Green functions of sphere and cylinder".

The problem of diffraction by sphere ^{or} cylinder can be solved by a series, the terms of which are Bessel functions of integer order times suitable angular functions. As those series are slowly converging for large objects, it is useful to transform them (after Watson) into series of Hankel functions of complex order satisfying the boundary condition. The terms of these series are rapidly decreasing in the geometrical shadow, if the object is large compared to the wavelength, so they can well be used for calculating the propagation of radio waves on the spherical earth. This is different in diffraction theory: here the geometrically lit region is of special interest, where the terms of Watson's series are increasing from beginning, and decreasing and leading to convergence only after much more terms than are necessary when using the original Bessel function series. Now the terms of the Watson series are identical with the "creeping waves" determined by K. Deppermann and myself from the integral equations of diffraction theory; they turned out to creep along the surface of the object and to radiate off tangentially. But besides of those creeping waves we got in the lit region a separate term representing a geometrically reflected wave. In this communication I can show, that it is possible to split off such a geometrical term in form of an integral also from the Watson series, and that the rest is a series, whose terms are strongly decreasing even in the lit region. A closer analysis, however, shows this decrease (here as well as with the original Watson series) to be due to a semiconvergent character of the series; later on the terms are increasing again to very large values, before they decrease finally. To split the diffracted waves into geometrical and creeping waves is of great advantage for the practical calculation of wave functions; the single terms which allow simple asymptotic expansions, are monotonic functions of distance and angle - the extrema of the real diffraction patterns are completely understood as interference of geometrical and creeping waves. To treat diffraction by general surfaces of small curvature it is important to know the exact creeping waves for sphere or cylinder, as it is possible to conclude with what amplitudes the creeping

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 from the edge of shadow of an arbitrary surface; their propagation along the surface can then be calculated by the integral equations.

Monday, September 13, 1954

Session D 2 :
"Miscellaneous Subjects"

C. MORAIS - "Le isomerie vettoriali nel progetto dei sistemi a duplice riflessione".

La direzione dello spigolo delle due superfici riflettenti é trovata come direzione unita nell'isomeria vettoriale che viene a istituirsi fra le due terne di vettori non complanari rispettivamente oggetto ed immagine.

C. MORAIS - "Il calcolo vettoriale e le omografie nel calcolo dei sistemi ottici".

Si studia il raggio luminoso sotto la forma vettoriale

$$\underline{P} = \underline{A} + a \underline{\bar{t}}$$

dove:

P ed A sono punti del raggio

a é uno scalare

 $\underline{\bar{t}}$ é il tensore

Il tensore $\underline{\bar{t}}$ viene espresso in funzione di due parametri u e v; i fuochi del pennello di raggi, avente come raggio medio il raggio considerato, vengono trovati studiando le direzioni unite della omografia $\frac{d\underline{\bar{t}}}{dP}$ che come é noto, é dilatazione.

Si studiano in seguito le espressioni dell'aberrazione di un raggio.

Monday, September 13, 1954

Session D 3 :
"Miscellaneous Subjects"

A. ARNULE = O. DUPUY = F. FLAMANT - "Méthode objective pour l'étude des défauts du système optique de l'oeil."

L'image d'une fente lumineuse formée sur la rétine sert de source pour étudier le système optique de l'oeil, en utilisant une méthode quelconque de mesure des aberrations, par exemple une méthode d'ombre. L'image de la fente, devenue incohérente par sa diffusion dans la rétine, ne conserve aucune trace de la distribution initiale des phases qu'il lui avait été imposé par la première traversée de l'oeil; les résultats obtenus ne feront donc intervenir que la seule traversée au retour du système optique de l'oeil. Par contre, la sensibilité sera réduite parce que la fente source est une image élargie par les aberrations, les micro-fluctuations de l'accommodation et la diffusion rétinienne.

Une des principales difficultés expérimentales consiste à obtenir une ouverture pupillaire suffisante, en utilisant une source intense, sans employer de mydriatique; elle a été résolue en superposant sur le même cliché plusieurs impressions produites par une lampe flash électronique, l'observateur fixant avec le plus grand soin un point de repère.

Cette méthode montre surtout l'aberration sphérique et les défauts d'homogénéité; elle est peu sensible à l'astigmatisme, bien que l'on puisse constater visuellement l'effet des fluctuations de l'accommodation.

On présente les photographies et les courbes d'un homme jeune. Les défauts d'homogénéité sont faibles, et la courbe d'aberration sphérique ressemble beaucoup à celle d'Ivanoff.

Monday, September 13, 1954

Session D 3 :
"Miscellaneous Subjects"

M. FRANCON - "Etude interférométrique des défauts de basse fréquence dans les états de surface".

Sauf pour les très petits défauts, le contraste de phase est d'application difficile lorsque l'on veut étudier les défauts de poli.

Les défauts larges correspondant à des termes de basses fréquences sont en effet arrêtés par la lame de phase.

Nous avons étudié un nouveau type d'interféromètre qui élimine ces difficultés tout en restant d'utilisation extrêmement simple. Il permet d'étudier et de mesurer les défauts de toutes périodes.

Monday, September 13, 1954

Session D 3 :
"Miscellaneous Subjects"

H.H. HOPKINS - "Interferometric methods for the study of diffraction images".

The photometric difficulties which are presented in direct measurements are discussed, and it is shown that a wavefront shearing and a wavefront tilting interferometer may be used to study respectively the transmission factors for any optical system with any mode of illumination and the amplitude and phase in diffraction images of point sources.

H.H. HOPKINS - "Transmission factors for incoherent objects in the presence of a defect of focus".

The integrals expressing the transmission factors corresponding to any focal plane for both circular and rectangular apertures have been evaluated. It is shown that the slope of the transmission frequency curve at zero and limiting frequencies is independent of the presence of aberrations - whether small or not. Curves are given showing the transmission curves for different focal planes for aberration-free pupils.

Monday, September 13, 1954

S e s s i o n E 1 :
"Aspheric Surfaces"

K.W. BRITTAN - "A new machine for producing non-spherical surfaces".

A description is given of a new type of machine for producing spherical and non-spherical surfaces. The position of the grinding tool is controlled with respect to the surface being worked by a cam rotating about the paraxial centre of curvature of the work. A lever working at a reduction of 40:1 communicates the displacement at the cam to the tool.

Some problems concerning the design of slides and pivots will be considered and special features of the machine will be described in detail.

Monday, September 13, 1954

Session E 1 :
"Aspheric Surfaces"

J. DEMARCO - "Sur la réalisation de quelques surfaces
asphériques de révolution."

Principe de la machine de Descartes. Quelques difficultés
de réalisation. Quelques exemples d'application.

Surfaces paraboliques convexes et concaves (résultats
actuels).

Polissage des verres asphériques.

Monday, September 13, 1954

Session E 1 :
"Aspheric Surfaces".

R.E. HOPKINS -"Use of aspheric surfaces in optical systems."

Several of the most economical methods for making aspheric surfaces will be discussed. Aspherics made from a few of these methods have been tested on an interferometer. The testing equipment and results will be illustrated.

Aspherics have been used in several optical systems such as camera lenses, eyepieces, and magnifiers. In refracting optical systems the aspherics are primarily used to introduce astigmatism. Several examples of these designs will be described.

Monday, September 13, 1954

Session F 1 :
"Optical Problems of
Television"

H.H. HOPKINS - "Objectives of variable focal length".

Some general properties of the Gaussian optics and
aberrations of systems of variable power are discussed.

Monday, September 13, 1954

Session F 1 :
"Optical Problems of
Television".

E.H. TRAUB - "Systems of TV film scanning".

ABSTRACT NOT RECEIVED

Monday, September 13, 1954

Session F 1 :
"Optical Problems of
Television"

F.I. HAVLICEK - "On a lens of high relative aperture".

Special needs find sometimes commercial optical systems inadequate to the purpose and to avoid lengthy calculations by trigonometrical methods it will be shown how far it should be possible to get with Seidel's theory only and by using trigonometrical methods for final checks. An example will be given.

Monday, September 13, 1954

Session F 1 :
"Optical Problems of
Television"

G. TORALDO - "The method of the "brightest green".

Color television receivers can be based on different principles. Either the images of the three fundamental colors are formed in the same tube, or there are three tubes, one for each color. In the latter case the three images must be projected and superimposed on the same screen.

This can be accomplished by means of a single lens. An extremely wide aperture is needed for obtaining sufficient brightness on the screen, with such an aperture it is difficult to obtain a very good resolving power.

Now it is known from experience that: (1) in three-color projection the resolving power required from the green image is considerably greater than that required from both the red and blue images, and (2) the luminance attainable with the green phosphor is at least four times the maximum luminance attainable with the red or blue phosphors.

The author's invention consists in utilising the same projection lens for the three colors but with a lesser aperture and consequently greater resolving power for green and with a larger aperture and less resolving power for both red and blue. To this end a green dichroic mirror with a hole of suitable size in the middle may be placed in front of the projection lens. Alternatively green rays may arrive at the projection lens after reflection on a green dichroic mirror occupying only the central part of the beam. In this manner one can utilise a lens having only poor resolving power, at maximum aperture, provided that the resolving power is good at about half-maximum aperture.

Tuesday, September 14, 1954

Session F 2 :
"Optical Problems of
Television"

Y. LE GRAND - "Physiologie de la télévision en couleurs".

Les procédés actuels de télévision en couleurs utilisent trois images (rouge, verte et bleu) et afin de ne pas élargir la bande transmise il faut profiter au maximum des limitations physiologiques de la rétine; on analyse les données expérimentales relatives à l'acuité colorée, afin de rechercher quelle finesse il suffit d'assurer à l'image bleue par rapport aux autres.

Tuesday, September 14, 1954

Session F 2 :
"Optical Problems of
Television"

G.A. BOUTRY - "L'oeil humain devant le spectacle de la
télévisi on".

1. Introduction. Télévision monochrome et Télévision en couleur. But et limites du présent exposé.
2. Télévision en couleur par synthèse additive. Primaires choisies. Choix de la luminance maximale utilisée dans cette étude. Luminance et couleur.
3. Pollution d'une image par "bruit de fond"; pollution d'une image par "diaphotie":
 - (a) cas de l'image monochrome: pollution des images fixes, pollution des images animées.
 - (b) cas de l'image colorée: virage des couleurs - valeur relative des pollutions admissibles.
4. Télévision en couleur par synthèse additive: le pouvoir séparateur de l'oeil. Examen et spectacle de télévision.
 - (a) comportement de l'oeil vis à vis des composantes rouge et verte de l'image;
 - (b) comportement de l'oeil vis à vis de la composante bleue.
 - (c) le pouvoir séparateur de l'oeil en l'absence des constantes de luminance.
 - (d) remarques sur l'artifice des "mixed-highs".
5. Papillotage et la reproduction du mouvement.
 - (a) rappel des résultats obtenus dans le cas de la télévisi on monochrome.
 - (b) télévision en couleur par synthèse additive: résumé d'une étude des papillotages.
6. Conclusion: règles pour l'établissement de systèmes rationnels de télévision en couleur. Système dit "à double programme".

Tuesday, September 14, 1954

Session F 2 :
"Optical Problems of
Television".

A. MAHNEKE - "Experimental flicker-fatigue and its possible relation to different light/dark ratios."

Exposure of the human eye to coarse flicker has been found to cause a decrease in flicker-fusion-frequency (FFF)(1,2)

The purpose of the following experiments was to ascertain, whether exposure of the human eye to coarse flicker of different light/dark ratios alters this decrease.

Results with two subjects, using an electronic flicker apparatus with automatic frequency variation (3), monocularly and with an artificial pupil of 0,2 cm diameter, 1,05 lux retinal illumination, corroborate the previously found decrease of about 10% after 10 minutes of exposure, but no significant influence of different light/dark ratios (10%, 50%, 90% light-time of a cycle).

The decrease and its influence on flicker-fusion determinations are discussed.

- 1) Snell, P.A. An introduction to the experimental study of visual fatigue. J. Soc.Motion Picture Eng. 20:367:1933
- 2) Berger, C.; Mahneke, A. Visual fatigue and its determination by two simple visual tasks. American Journal of Psychology Sept. 1954
- 3) Berger, C; Mahneke, A.; Mortensen, O. An electronic flicker apparatus with automatic frequency variation. J. opt. soc. America in press.

Tuesday, September 14, 1954

Session F 2 :
"Optical Problems of
Television"

G. GIOTTI - "A device for observing television and motion picture images".

The optical properties of a simple catoptric device, proposed by Eng. Luigi Cristiani, are investigated.

After determining the best conditions of use, the characteristics of the image obtained with the system are illustrated. The points particularly referred to are: the apparent magnitude - the plastic effect which reminds of stereoscopy - the correction of the television image curvature - and the brightness.

Tuesday, September 14, 1954

Session G 1 :
"Retinal Problems"

M.A. BOUMAN - "On foveal and peripheral interaction in binocular vision".

Contrast and increment thresholds were measured by presentation of the teststimulus in one of the eyes, adapting fields of mutually different brightnesses and colours being incident in both eyes.

Essentially no influence was found on threshold value under such stimulation of the opposite eye, the threshold being equal to the value referring to exclusive stimulation of the measuring eye.

Periods of dominance of the various stimuli in the conscious perception under certain conditions can easily be recognized. Measurements of increment thresholds under fluctuating illumination of the opposite eye at various stadia of the light-dark ratio of such stimulation show a complex behaviour apparently due to a non peripheral mechanism.

Some suggestions are made as to a possible influence of attentional effects on such measurements.

Tuesday, September 14, 1954

Session G 1 :
"Retinal Problems"

C. BERGER - "A flicker test of interaction in the human fovea".

Flicker Fusion Frequency (FFF) in human vision has been found to be affected by the illumination of the surrounding field (1,2). The experiments reported here were conducted in order to ascertain, whether such surround-effects depend upon "entoptic stray-light"(3), size of flicker-test and structure of surrounding field.

Experiments with superimposed steady light ("artificial stray-light") show that "entoptic stray-light" plays no significant role. (Fig.2). Image-size of test-area and structure of surrounding field have a decisive influence upon the surrounding field effect on FFF. Illumination of an immediately adjacent white field does not affect FFF, when very large or very small foveal areas are tested (Fig.3). Maximal surround effects for areas around 1' in diameter consist in an increase of FFF with increasing surround-illumination up to a maximum, when surround and test-illumination are equal, decreasing again with further increase of surround illumination.

With increasing illumination of the white part of a mixed black and white surround (Fig.4), FFF increases almost independently of the size of test-field up to the highest surround illumination-levels (4).

Interpretations of the results as due to foveal interaction between different "functional units", inside "receptive field" (5), or between single receptors, the role of "contrast" (6) and artificial stray-light, considering FFF as "visual temporal acuity" or "successive brightness discrimination" are discussed (7).

- REFERENCES: 1) Fry, G.A. and S.H. Bartley, J. Exp. Psych. 1936. 19.351
2) Lythgoe, R.J. and K. Tansley, Medical Research Council, Report No.134, 1929, London.
3) Bartley, S.H. Handb. Exp. Psych. 1951.925
4) Berger, Curt, Acta Phys. Scand. 1954.30.2/3.161
5) Hartline, H.K., H.G. Wagner and E.F. Nichol jr., Cold Spring Harbor Symposia on quant. Biol. 1952.17.125
6) Kuffler, S.W., J. Neurophys. 1953.16.37
7) Callaway, T.A. "The Human Senses" 1953. 90

Tuesday, September 14, 1954

Session G 1:
"Retinal Problems"

A. KUHL - "Visual acuity as a problem in functional association of retinal elements".

It is shown, that in measuring visual acuity by the "minimum visible" (circular test) the functional association of retinal elements is identical with that in measuring threshold-discriminations, whereas in measuring v.a. by the "minimum legible" (Landolt-ring) and the "minimum separable" (Foucault-grating) another series of functional association takes place, differing from the first one about another threshold-discrimination.

Tuesday, September 14, 1954

Session G 1 :
"Retinal Problems"

H. SCHÖBER - "Über den Einfluss des Formensehens und des Richtungserkennens auf die Messung des Auflösungsvermögens des Auges mit Hilfe des Landolt'schen Ringes."

Es ist schon lange bekannt, dass es kein Kriterium für die Messung des Auflösungsvermögens des menschlichen Auges gibt, das frei von den Einflüssen anderer Sehfunktionen, vor allem der Unterschiedsempfindlichkeit und vom Formensehen ist. Der Landolt'sche Ring stellt unter allen zu diesem Zweck benutzten Zeichen neben den Foucault'schen Streifen zweifellos das beste Mittel dar. Die vom Vortragenden an einer grossen Anzahl von Messungen gemachten Beobachtungen über die Fehlerverteilung lassen den Schluss zu, dass auch noch auf eine andere Grundfunktion des Gesichtssinnes, nämlich das Erkennen von Richtungen besondere Achtung zu legen ist. Die wirkliche Ringstellung wird am häufigsten um 180° falsch angegeben und zwar unabhängig davon, ob der Schlitz vertikal, horizontal oder in schräger Richtung liegt. Offenbar ist die Richtungserkennung eine Grundfunktion, die sogar noch früher eintritt als das Formensehen.

Sobald ein Lichtreiz entdeckt wird, versucht der Gesichtssinn eine Annahme über seine Lage im subjektiven Sehraum zu machen. Die Bedeutung der frühzeitigen Richtungserkennung erscheint begreiflich, weil die Blickbewegungen nur nach der Lage des gesehenen Objektes im Gesichtsfeld gesteuert werden können.

Tuesday, September 14, 1954

Session G 2 :
"Retinal Problems"

R. GRANIT - "Centrifugal and antichromic effects on the retina".

The Horsley-Clarke stereotaxic orientating instrument has been used to stimulate locally in the brains of cats while records have been taken with microelectrodes from the animals retinal ganglion cells.

The frequency of the retinal spikes can be diminished or increased by some seconds of repetitive stimulation in either of two places in the brain:

- (1) the reticular system in the brain stem
- (11) the end points of the optic nerve fibres in the geniculate body, pretectum or superior colliculos. In the latter place the centrifugal effect presupposes backward or antichromic stimulation of the optic nerve fibres. Slides will be shown to demonstrate these effects. Their relation to the centrifugal fibres of Cajal will be discussed.

Tuesday, September 14, 1954

Session G 2 :
"Retinal Problems"

A. MANFREDI - "Fosfeni rotatori per stimolazione con correnti alternate".

L'autore riassume le risultanze delle ricerche del Motokawa sulla stimolazione per mezzo di correnti alternate a bassa frequenza dell'apparato visivo umano. Passa quindi a descrivere i fosfeni che si generano per applicazione di due correnti alternate ai due apparati visivi di un soggetto.

Quando le due correnti hanno frequenza poco differente appaiono fosfeni a strie luminose che si spostano lungo archi di circonferenza.

L'autore presenta infine grafici relativi all'andamento del fenomeno.

W.A.H. RUSHTON - "Changes in rhodopsin density measured ophthalmoscopically in man and animals during light and dark adaptation".

When the fundus oculi is observed through an ophthalmoscope, the image is observed in light which has passed twice through the rhodopsin of the retina. Rhodopsin density change can therefore be measured by accurately determining the fraction of incidence green light which is reflected back from behind the retina. One method of doing this is to use a flickering light, where half a cycle is green and half orange. The reflected light is received upon a photo-multiplier tube and the output is seen in general to be different for two lights. By adjusting a magenta optical wedge in the input beam, the two photocell outputs may be equalized. Any change in rhodopsin upsets the equality, which is restored by resetting the wedge. In this way rhodopsin changes are read off directly from the wedge settings after suitable calibration. A measurement takes about 15 sec. to make. Curves have been obtained for light and dark adaptation in various conditions, and values have been found for the fraction of light absorbed by rhodopsin in the dark adapted state, and for the retinal illumination at which the rhodopsin level begins to fall.

Wednesday, September 15, 1954

Session G 3 :
"Retinal Problems"

W.D. WRIGHT - "The role of stray light in glare and contrast phenomena".

The effect of glare source in lowering the luminosity of a nearby object has been attributed in recent papers (for example, G.A. Fry and M. Alpern, J. Opt. Soc. Am., 43, 189, 1953) to the effect of scattered light in the eye, in contrast to the suggestion of Schouten and Ornstein (J. Opt. Soc. Am., 29, 168, 1939) and others that physiological processes in the retina (perhaps some form of inhibition) may be responsible. The evidence for these two theories is reviewed and discussed in relation to the more general study of contrast phenomena.

Wednesday, September 15, 1954

Session G 3 :
"Retinal Problems"

F. FLAMANT --"Contribution à l'étude des distributions d'éclairement des images rétiniennes."

On a employé au début une méthode subjective, mais qui n'a pas permis de fixer l'ordonnée correspondant au maximum de la courbe de l'image d'un point. On a ensuite utilisé une méthode objective, consistant à photographier l'image rétinienne d'une fente d'éclairement variable, obtenu en plaçant devant elle un coin photométrique. L'image obtenue est très fine; on diminue beaucoup l'effet de la granularité de l'émulsion utilisée, en opérant sur une photographie composite obtenue à partir de 10 clichés originaux.

- (1) On a obtenu une courbe moyenne pour 7 observateurs: cette courbe diffère beaucoup d'une figure de diffraction étant, en particulier, bien plus étalée à la base.
- (2) La forme de cette courbe peut être retrouvée par le calcul, en combinant l'effet d'une distribution d'éclairement par diffusion suivant la loi de Lambert, et d'un défaut de mise au point produisant un écart de $\lambda/2$ sur la surface d'onde, et correspondant aux microfluctuations de l'accommodation.

Wednesday, September 15, 1954

Session G 3 :
"Retinal Problems"

LUCIA RONCHI - "On the additivity of light stimuli on the retina".

By means of a so called pupil sensitometer, the Stiles and Crawford effect for a single observer has been measured.

By plotting the log of pupil efficiency against ^{square} absissae of points of entry an approximately straight line is obtained. It is of interest to evaluate the slope of this line.

By using a mydriatic the value of the slope is found to be nearly half the value obtained without dilating the observer's pupil.

The integrated Stiles and Crawford effect has been measured for the same observer. From some preliminary experiments coherent stimuli coming from different points of the pupil and overlapping on the same retinal area seem to be additive.

Other measurements, concerning the same problem, have been performed by the same observer by means of an experimental device involving a flicker photometer.

Wednesday, September 15, 1954

Session G 3 :
"Retinal Problems"

S.S. BALLARD - "A program of research in the visual detectability of distant objects".

A University of California laboratory devoted to basic research on the limiting capabilities of the human observer to detect distant objects seen through the atmosphere or through ocean water has been established at the Scripps Institution of Oceanography, La Jolla, California. Photometric data on a wide variety of objects, and the laws of image transmission by the atmosphere or by sea water, are combined with data describing the limiting performance properties of the human observer to predict those circumstances under which a given distant object can be seen. Field experiments under carefully measured atmospheric and lighting conditions have demonstrated the validity of this procedure. Scientific by-products of this program include a study of the penetration of daylight into the sea and its relation to ecological processes in the ocean.

Wednesday, September 15, 1954

Session G 4 :
"Retinal Problems"

M. AGUILAR = J. OLIVA - "Distribución de las unidades sensoriales en la retina extrafoveal".

En esta comunicación investigamos la simetría circular de la retina extrafoveal en un campo de 60° en lo que se refiere a la agudeza visual íntimamente relacionada con la distribución de las unidades sensoriales en la misma.

Los resultados obtenidos nos permiten comprobar la existencia de esta simetría junto con el aumento en el tamaño de las unidades sensoriales y consiguiente decrecimiento de la agudeza visual a medida que nos alejamos de la fovea.

Wednesday, September 15, 1954

Session G 4 :
"Retinal Problems"

J.M. OTERO = J. CASAS - "Sobre la teoria de anteojos nocturnos"

Se investigan las condiciones de aumento de visibilidad nocturna cerca del umbral absoluto en la detección de manantiales puntuales y extensos, observando a través de instrumentos telescópicos.

Cuando el ángulo subtendido por el estímulo es muy pequeño intervienen fundamentalmente los fenómenos de difracción más ó meno modificados por la presencia de aberraciones; pero al salirse de manantiales puntuales o casi puntuales comienzan a jugar un papel preponderante las leyes óptico-fisiológicas que relacionan los umbrales con el área del estímulo.

La influencia decreciente de este área al aumentar al ángulo permite determinar para cada caso los aumentos más favorables y el límite más allá del cual el instrumento de observación deja de ser útil al disminuir la luminancia del estímulo sin que esta disminución pueda ser compensada por el efecto de los aumentos.

Se dan tablas y fórmulas empíricas para calcular constantes geométricas de los anteojos nocturnos más convenientes en cada caso.

Wednesday, September 15, 1954

Session G 4 :
"Retinal Problems"

A. BIOT - "Remarques sur un phénomène signalé par M. Toraldo di Francia".

On résume d'abord les résultats publiés jusqu'ici. (Il s'agit de l'observation d'un champ lumineux uniforme à travers un trou percé dans un écran opaque tenu devant l'oeil).

On rapporte ensuite ceux auxquels on est arrivé en plaçant une lampe entre l'oeil et le trou, celui-ci n'étant pas au point. On remarque, en particulier, que si après une observation - faite de préférence sur un fond bien éclairé - on porte le regard sur le fond, on aperçoit une tache sombre correspondant à l'endroit de la rétine adaptée aux éclairissements observés dans le trou. Cette observation explique la différence de luminosité, constatée entre la région centrale et la région périphérique. On peut aussi s'en servir pour expliquer l'anneau clair qui a été décrit en tenant compte peut-être d'un effet de contraste.

Wednesday, September 15, 1954

Session G 4 :
"Retinal Problems"

A. FIORENTINI - "L'influence des gradients d'éclairement rétinien et de leurs variations sur la sensation subjective de brillance".

Le même effet qui a lieu lorsque on regarde un champ uniforme à travers d'un trou circulaire placé près de l'oeil, a été observé aussi en regardant la pénombre d'un objet éclairé par une source étendue: près du bord du champ éclairé on voit une ligne très brillante.

On a prouvé que cette ligne a une origine purement subjective et on a mis en relation ce phénomène avec celui découvert par Mach (1865) en des conditions un peu différentes. L'effet est produit par une soudaine variation du gradient d'éclairement sur la rétine.

On a cherché à déterminer la relation entre la brillance du champ et le gradient minimum qui permet de percevoir la ligne brillante.

En suite on a étudié l'influence du temps d'observation sur la visibilité de la ligne; on a trouvé qu'elle est moins aisément visible lorsque le temps d'observation devient inférieur à 1 seconde.

Wednesday, September 15, 1954

Session G 5 :
"Retinal Problems"

R.W. DITCHBURN - "Eye movements in relation to retinal action".

It is assumed in many theories of retinal action that the response of a receptor is determined by the intensity of the light falling upon it. Some theories assume that the response of a receptor is at least partly determined by the rate of change of intensity of the light falling upon it.

If the second type of theory is correct eye-movements play an important part in determining the response of the eye to a given stimulus. A technique for studying the response when the image on the retina is stationary is described and this gives evidence in favour of the second type of theory.

Wednesday, September 15, 1954

Session G 5 :
"Retinal Problems"

A. FIORENTINI = A.M. ERCOLES - "Recherches sur le rôle des
petits mouvements des images
par rapport à la rétine."

En utilisant une méthode suggérée par Ratliff et Riggs on a
trouvé que le pouvoir séparateur de l'oeil, ainsi que le pouvoir
de perception d'un fil, décroît lorsque on empêche les mouvements
des images par rapport à la rétine, qui seraient dus aux petits
mouvements de l'oeil.

Le même fait a été mis en évidence partant d'un autre point
de vue. On a mesuré le pouvoir résolvant en regardant un réseau
soumis à un mouvement harmonique autour de sa position de repos.
On a fait varier la fréquence de ce mouvement dans un certain
intervalle.

Le pouvoir séparateur devient plus petit au fur et à mesure
que l'amplitude angulaire du mouvement augmente. Mais la perte
de visibilité des traits du réseau est toujours petite par rap-
port à la diminution du contraste due au mouvement.

Wednesday, September 15, 1954

Session G 5 :
"Retinal Problems"

A. MANFREDI - "Nuovo metodo di sensitometria visuale obbiettiva."

L'autore descrive brevemente i principi sui quali si basa il rilievo del riflesso psicogalvanico e quello, da lui recentemente introdotto, del riflesso psicovoltaiico. Passa quindi ad illustrare come, attraverso questi rilievi, sia possibile misurare, in modo obbiettivo, la acuità sensitiva di un qualunque organo di senso e come ciò venga fatto correntemente in campo audiologico per la determinazione della acuità uditiva, in particolare dei residui uditivi nei bambini sordomuti. Riferisce quindi delle prime esperienze fatte da lui e di quelle fatte in collaborazione con il Prof. L. Fiori-Ratti per l'applicazione del metodo nel campo della sensitometria visiva.

Wednesday, September 15, 1954

Session G 5 :
"Retinal Problems"

E. INGELSTAM - "Possible interpretations of the ultrastructure
of retinal receptors".

ABSTRACT NOT RECEIVED
